Department of FACILTY MAINTENANCE
Stormwater Workshop

POST CONSTRUCTION BMP LESSONS LEARNED

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AGENDA

- THANK YOU
- PLANNING
- DESIGN
- CONSTRUCTION
- QUESTIONS

PLANNING LESSONS LEARNED

Post-Construction BMPs and Low Impact Development

UNDERSTAND SITE

- MICRO ENVIRONMENTS
  - SHADE – SUN
    - Saint Augustine; Bermuda
  - EXPOSURE TO BRACKISH WATER
    - Seashore Paspalum
  - HIGH TRAFFIC
    - Solid Turf over Seed
  - WINDWARD (wet) – LEEWARD (dry)
    - Soil Type
    - Plants tolerant of high moisture
    - Beach plants

UNDERSTAND SITE

- Maili Beach Park

UNDERSTAND SITE

KING TIDE: 5/25/2017 PEAK HIGH TIDE; PHOTO by ESH

UNDERSTAND CLIENT

- MAINTENANCE CAPABILITIES
  - NO ADDITIONAL MAINTENANCE STAFF
  - NO NEW EQUIPMENT
    - MOWER, WEED WACKER
    - BLOWER, RAKE
    - PRUNER

UNDERSTAND CLIENT

UNDERSTAND CLIENT

CHECK LIST ITEMS TO CONSIDER

- ✓ SITING
- ✓ PROVIDE PUBLIC AWARENESS SIGN
- ✓ PLANTS SELECTED FOR ENVIRONMENT. SHADE, SUN, BRACKISH WATER, HIGH GROUND WATER, CLOSENESS TO STREAM, LOW SPOT.
- ✓ SOLID TURF FOR HIGH TRAFFIC AREAS OR QUICK TURNOVER
- ✓ CLIENT MAINTENANCE ABILITY

DESIGN LESSONS LEARNED

Post-Construction BMPs and Low Impact Development

Lessons Learned – PREVENT

Lessons Learned – EDUCATE

Lessons Learned – EDUCATE

Protecting Waters of Kalihi Using Low Impact Development

Kalihi Valley Watershed

The Kalihi Watershed is marked as the area surrounding Kalihi Stream, from the mountains to the ocean. Within this watershed are conservation, residential and industrial land uses. Kalihi Stream is impacted from polluted runoff coming from these lands.

HOW THE CITY PROTECTS YOUR WATER:

- Plant debris and sediment removal from storm drainage system
- Debris/trash removal and maintenance of City owned streams, channels and canals.
- Erosion control projects
  - Grassing and irrigating exposed soil areas on City properties
- Offers household hazardous waste (and other) recycling for residents
- Street sweeping
- Low Impact Development (LID) Projects
- Illegal dumping and connection investigations and enforcement
- Industrial, commercial and construction site inspection and enforcement.

The City and County of Honolulu's improvements to the Kalihi Police Station and Kalihi Valley District park included the installation of Low Impact Development practices, which are aimed at improving water quality in Kalihi Stream.

Visit www.cleanwaterhonolulu.com
to learn how you can protect our waters

What is Low Impact Development?

Low Impact Development (LID) are innovative practices that mimic nature to detain and filter storm water runoff. Examples of LID are rain gardens, bio-swales, rain water collection and green roofs. Installing LID at points where storm water runoff can be intercepted and filtered before reaching the storm water sewers helps to improve the water quality in receiving streams and the ocean.

How do these LIDs treat runoff?

The first flush storm water runoff filters through a planted layer with amended soil. Pollutant removal includes filtration, adsorption to soil particles and biological uptake by plants

Pollutant	Source
Nutrients (Nitrogen and Phosphorus)	conservations lands, urban pollution and fertilizers
Suspended Solids (Sediment)	Erosion
Trash	Improper disposal of waste/liter
Bacteria	Pet and other waste products
Pesticides	Over application, historical practices
Metals	Tires, brake pads and roofs

STEALTH RAIN GARDEN at Kalihi Valley District Park

What is a Stealth Rain Garden? A rain garden is a planted depressed section of land where rainwater runoff can collect and soak into the soil. They are good for slowing down runoff from impervious surfaces, filtering rainwater, replenishing our groundwater supply and ultimately decreasing the amount of pollutants that wash into our streams and oceans. This **Stealth Rain Garden** will use no plants and instead use Saint Augustine Grass and amended soil.

BIO-RETENTION SWALE at Honolulu Police Department Kalihi Station

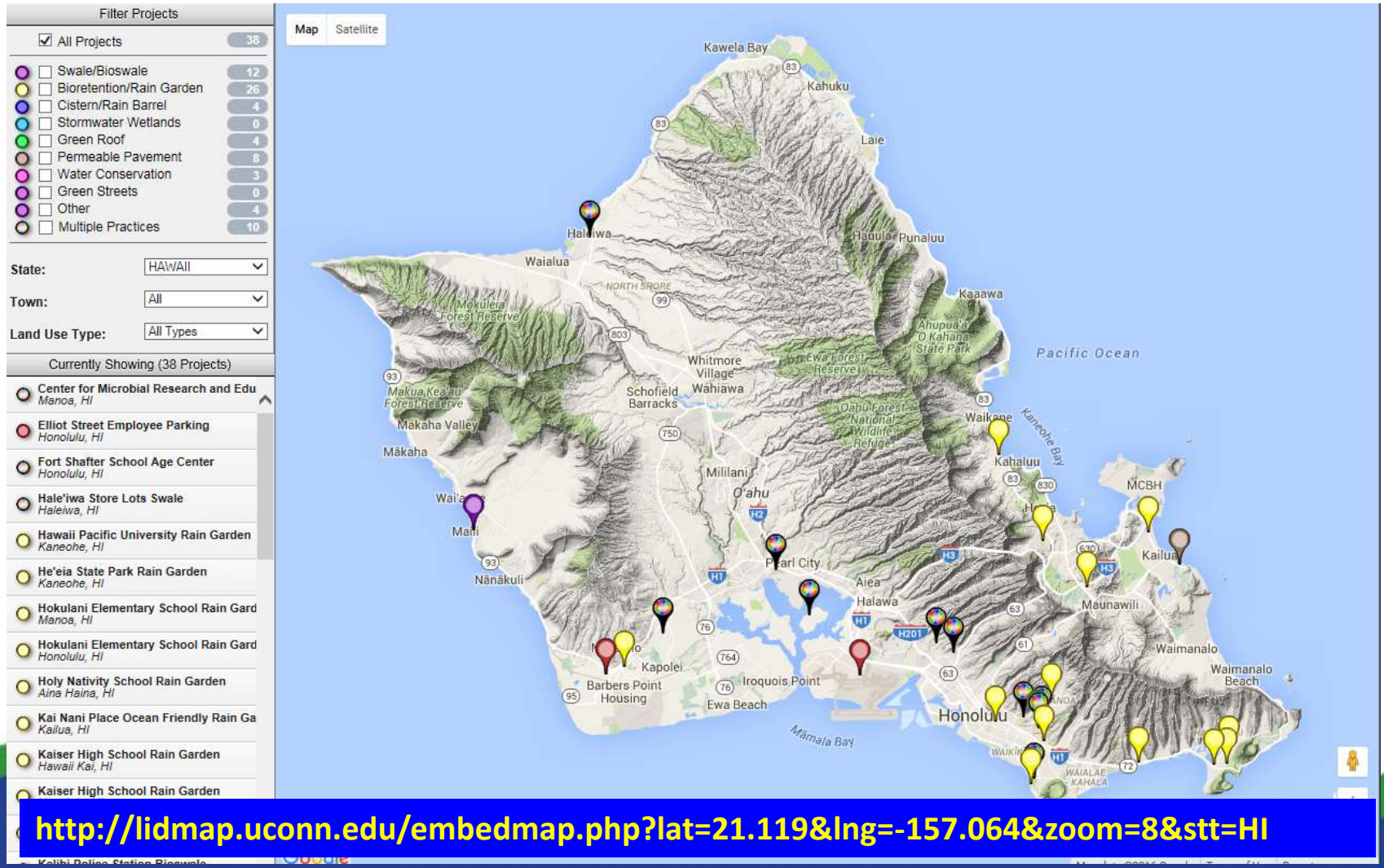
Within the Kalihi Police Station parking lot, the city installed about 60 lineal feet of **bio-retention swale** downstream of the parking area that is supplemented with a trench drain filter. Runoff is treated in the bio-swale before going into the storm drain. For small storm events runoff from pavements and associated pollutants are retained and infiltrated in the bio-retention swale.

Carex Grass

The swale is landscaped with a sedge grass named Carex. It's blades curve down, allowing it to slow the velocity of flowing water. Carex is great for landscaping because it doesn't need to be cut as often as turf grass.

Lessons Learned – EDUCATE

Lessons Learned – EDUCATE DESIGN STAFF

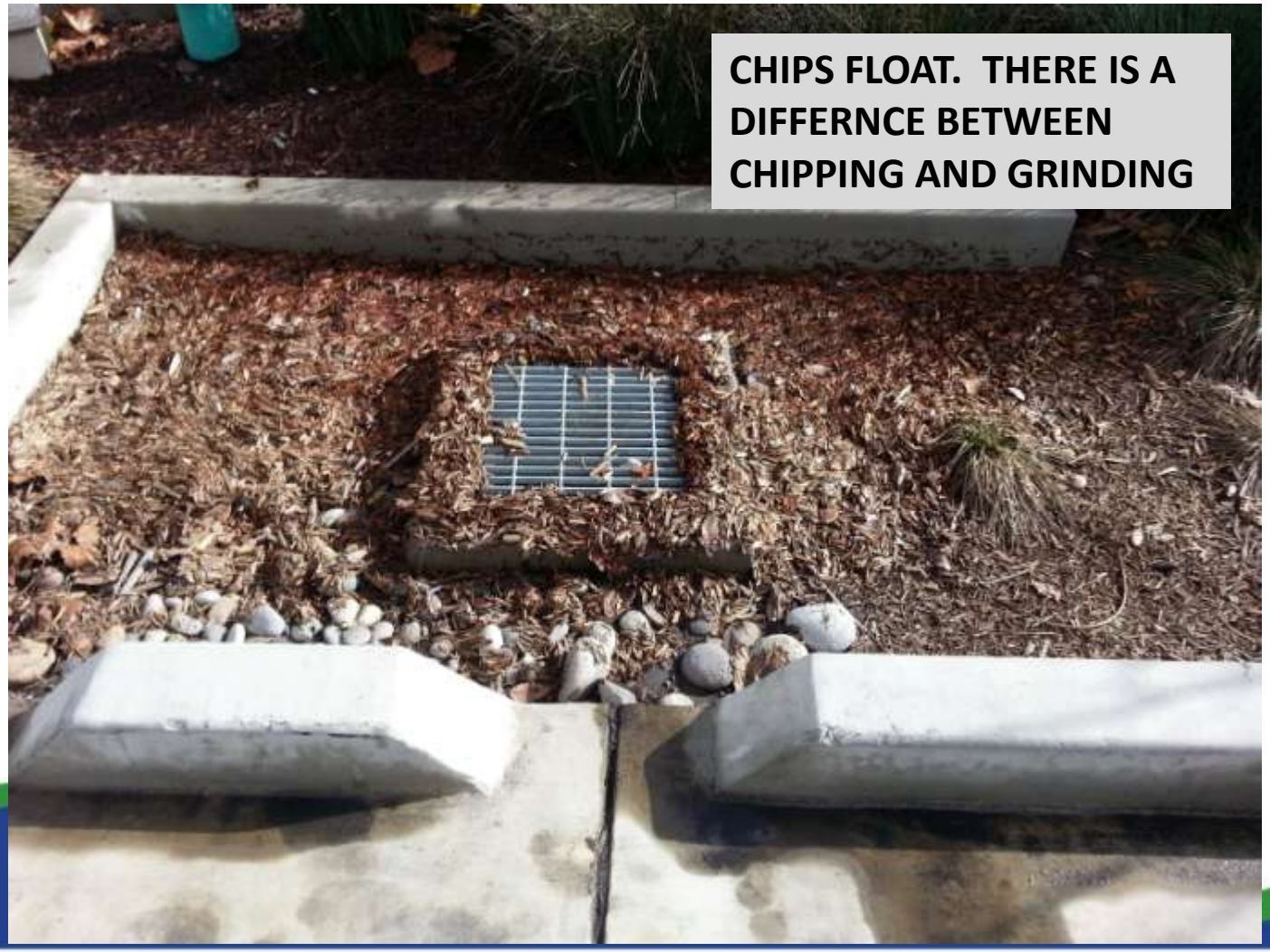


Lessons Learned – PERVIOUS CONCRETE

Lessons Learned – BIOINFILTRATION

KNOW YOUR EROSIVE VELOCITIES. ROCK AT CURB CUTS.

Lessons Learned – BIOINFILTRATION

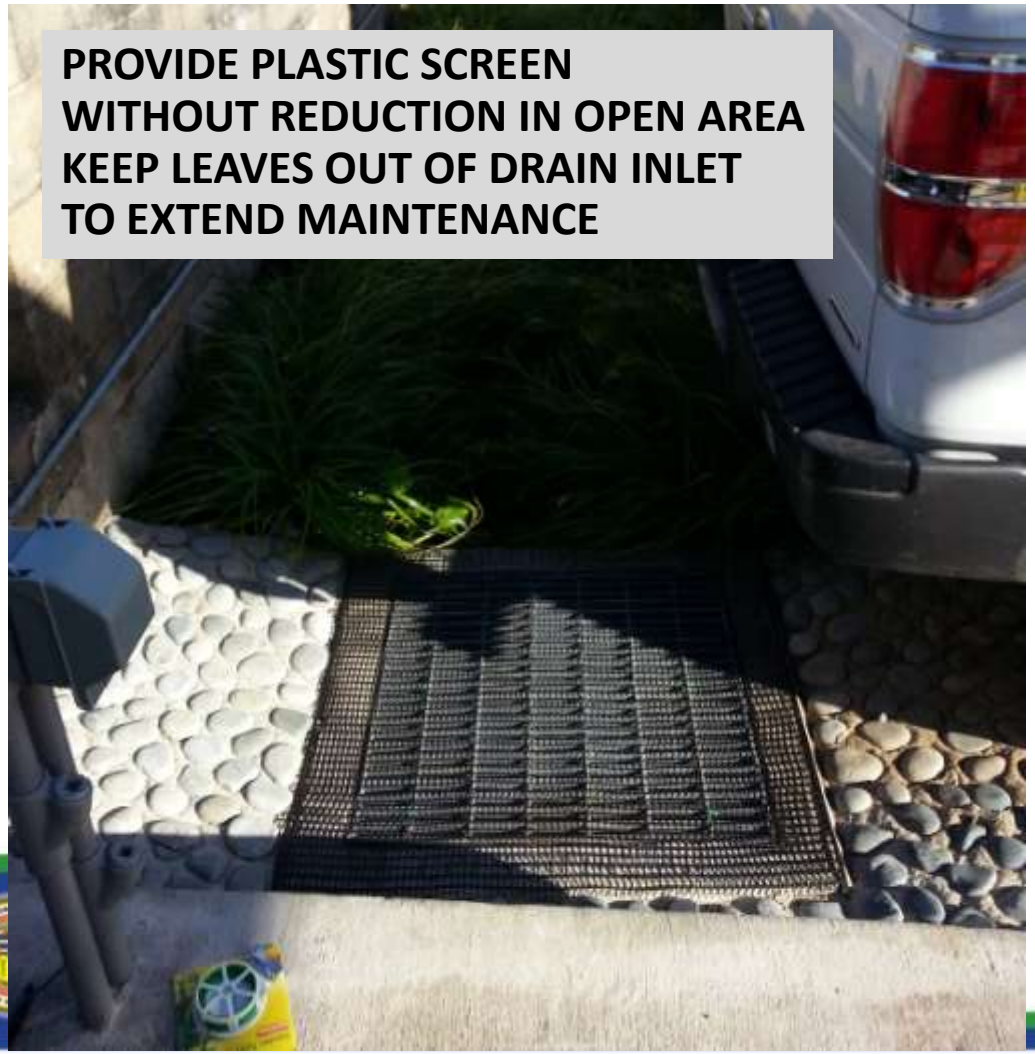


Lessons Learned – IT RAINS

Lessons Learned – IT RAINS

TEMPORARY EROSION CONTROL MATTING IN LOW POINT

Lessons Learned – DRAIN INLETS



Lessons Learned – VEGETATIVE SWALES

CHECK LIST ITEMS TO CONSIDER

- ✓ ENERGY DISSIPATION AT CURB CUTS
- ✓ EROSIVE VELOCITIES OF AMENDED SOILS DURING CONSTRUCTION. IT RAINS DURING CONSTRUCTION!!!
- ✓ BMPs TO SLOW WATER VELOCITIES
- ✓ EQUAL OPEN AREA SCREEN TO KEEP LEAVES OUT
- ✓ PUBLIC AWARENESS SIGN

CHECK LIST ITEMS TO CONSIDER

- ✓ USE SEPARATE SHEET TO INDENTIFY POST CONSTRUCTION BMPs
- ✓ SEDIMENTATION BASIN TO BIOINFILTRATION BASIN; DRAWINGS IDENTIFY RAKING; DRAWINGS PROHIBITING SCOOPING
- ✓ USE PROTECTION NOTES ON SHEET; CONSIDER INSTALLATION OF LID AFTER UPSTREAM VEGETATION IS IN PLACE; ELSE PROVIDE TEMPORARY BMPS TO PROTECT LID FEATURE

CHECK LIST ITEMS TO CONSIDER

- ✓ PHASE BIOINFILTRATION TILL AFTER LANDSCAPING
- ✓ SEDIMENTAION BASIN BOTTOM ELEVATION HIGHER THAN FINAL BIOINFILTRATION BOTTOM TO ALLOW RAKING AND REMOVAL OF SEDIMENT.
- ✓ RESTRICT CONSTRUCTION TRAFFIC AND ESPECIALLY LANDSCAPE TRAFFIC OVER PERMEABLE PAVEMENT
- ✓ NEXT PROJECT, CAN PERVIOUS CONCRETE HANDLE CONSTRUCTION VEHICLE LOADS?

CHECK LIST ITEMS TO CONSIDER

- ✓ EXTENDED MAINTENANCE PERIOD; DEFINE MINIMUMs (QUARTERLY, MONTHLY)
- ✓ PROTECTION OF EXIST LID ON DESIGN DWG
- ✓ REPLACEMENT OF PLANTS AND GRASS.
- ✓ O&M MANUAL; LOCATION OF LID
- ✓ INCORPORATE LESSONS LEARNED INTO COMPANY REVIEW CHECKLIST

Other LID Examples

Other LID Examples

Other LID Examples

Other LID Examples

Other LID Examples

Other LID Examples

Other LID Examples

CONSTRUCTION LESSONS LEARNED

Post-Construction BMPs and Low Impact Development

Lessons Learned – SUBGRADE

Figure 7. The rake method (A) for excavating the bottom of a bioretention cell creates less compaction than the scoop method (B).

Ref: Robert A. Brown, E.I.; William F. Hunt, P.E., Ph.D.; Urban Waterways, Improving Exfiltration from BMPs: Research and Recommendations, NC State University & A&T State University

Lessons Learned – TOP SOIL

Lessons Learned – DRAIN INLETS

Lessons Learned – HIGH FLOW & VOLUME

Walmart, American Canyon, CA

Lessons Learned – CONCRETE

Lessons Learned – CURB

Lessons Learned – RETROFIT

Lessons Learned – CURB CUTS

CHECK LIST ITEMS TO CONSIDER

- ✓ PRECONSTRUCTION MEETING TO INCLUDE DISCUSSION LID CONSTRUCTION
- ✓ DISCUSS RAKING OF SUBGRADE
- ✓ DISCUSS IF WATER QUALITY BASIN IS RECEIVING WATER FROM LARGE DRAINAGE AREAS
- ✓ NO CONSTRUCTION EQUIPMENT OVER EXIST. PERVIOUS CONCRETE

CHECK LIST ITEMS TO CONSIDER

PLANNING
Incorporate Lessons Learned From Last Construction; Client

ISO 9001
ISO 15001

CONSTRUCTION
Capture Lessons Learned Visit Site During Rain; Store In Database

DESIGN
Incorporate Lessons Learned Pass; Pull From Data Base

QUESTIONS